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Cover: Lugo's alligator lizard, *Gerrhonotus lugoi*, municipality of Mina, Nuevo León, Mexico. Photograph by Daniel Montoya-Ferrer.

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Notes on Mexican Herpetofauna 37: A Range Extension for Lugo's Alligator Lizards (*Gerrhonotus lugoi*; Squamata: Anguidae) in Nuevo León, Mexico, with Comments on Some Ecological Traits

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Paola Elianne López-Villa¹ and Larry David Wilson³

Background

Lugo's alligator lizards (*Gerrhonotus lugoi* McCoy, 1970) until quite recently were thought to be endemic to the state of Coahuila, Mexico, and in particular exclusive to the Cuatro Ciénegas Basin in the center of that state. The original description in 1970 mentions that the holotype was collected under natural conditions in a rock slide on the north side of the Sierra de San Marcos, in the Cuatro Ciénegas Basin, remarking that the individual went underground upon pursuit. Other individuals as well have been observed employing this form of escape behavior. That first observation over 30 years ago made note of the strange habitat preference for this lizard, arguing that most anguids don't prefer arid environments, and in general those that do inhabit such environments tend to live in higher mountain ranges. This species, however, is very well adapted to the xeric areas in which it exists (McCoy, 1970). Despite having been discovered and described more than 30 years ago, very little has been documented about this species. Lazcano et al. (1993) described its reproduction in captivity, from a gravid female brought into the lab, but much of its ecology is still unknown.

García-Vázquez et al. (2016) documented the discovery in 2010 of a specimen of *G. lugoi* at Rancho El Cuarto in the municipality of Mina (area 3,915.8 km²), Nuevo León. Until that discovery the species had been thought to be endemic to Coahuila. The municipality of Mina is bordered by three municipalities in Coahuila—Candela, Castaños and Ramos Arizpe. Two of these, Castaños and Ramos Arizpe, in turn border the municipality of Cuatrociénegas, where *G. lugoi* was first documented by McCoy (1970). This finding not only expanded the distribution range of this anguid, but also provided a new reptile record for the state of Nuevo León. The specimen was recorded as “active on the ground,” and associated with low, densely growing desert shrub vegetation (García-Vázquez et al., 2016). This habitat is similar to that present in the locality where the holotype was collected.

Gerrhonotus lugoi is not currently protected by national or international laws. It is given No Status by SEMARNAT (2010), and is listed as Least Concern by IUCN (2020). The Environmental Vulnerability Category score is High (16), as calculated by Lazcano et al. (2019). The species is found in Coahuila and Nuevo León in the physiological regions known as the Sierras y Llanuras Coahuilenses and Pliegues Saltillo-Parras. It is endemic to Mexico (Nevárez-de los Reyes et al., 2016).

Study Site

The municipalities of García and Mina, in the state of Nuevo León are largely arid areas with mostly microphyllous desert scrub and rosettophyllous desert scrub vegetation communities, as well as some piedmont, and small areas of pine and pine-oak forest in the relatively high altitude points of García. The dominant plant forms in most of the plains, low areas and some hills are creosote bush (*Larrea tridentata*) and a wide range of native desert-dwelling plants, such as succulents (Agavaceae, Bromeliaceae, Cactaceae, Euphorbiaceae and Nolinaceae), as well as some large trees adapted to this harsh environment (Fabaceae). The vegetation mostly present on the western side of the Sierra Nacatas (SN), in García; and along the road to San José de la Popa (RSJP) in Mina, is characterized by microphyllous desert scrub and rosettophyllous desert scrub. In the case of the western slope of the SN, the vegetation is naturally dominated by the creosote bush, with lesser, spotty representation of rosette plant forms like lechuguilla (*Agave lechuguilla*) and Mexican grass tree (*Dasyllirion cedrosanum*). Along the RSJP, where the creosote bush is equally dominant, the rosette plant forms include the rough agave (*Agave asperrima*), a large century plant that offers a large vegetation coverage in the area. The flower spike of the rough agave in some cases reaches four meters in height. Other rosette plants found in this area are the lechuguilla, dwarf needle agave (*Agave striata*) and barreta (*Hechtia parvifolia*).

Materials and Methods

We conducted various field trips (March–June 2020) to the municipalities of García and Mina. The area is considered rural but it is close to the Metropolitan Area of Monterrey. By day we mainly photographed local herps and habitat. By night we would drive the local roads looking for DORs and AORs to save from being run over. Although these rural roads have very low traffic, we have still found a good number of DORs that are now part of the preserved collection of the Universidad Autónoma de Nuevo León, Facultad de Ciencias Biológicas (UANL-xxxx). Materials used for our survey trips include leather gloves, snake hooks, infrared thermometer GPS, photographic camera (Nikon D7000), field journal, and plastic containers.

Information regarding the microhabitat preferences for *Gerrhonotus lugoi* was lacking. There was no specific methodology recommended for finding the lizard in habitat.

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Figure 1. Specimen of *Gerrhonotus lugoi* captured by Paola Elianne López-Villa on the western side of the Sierra Nacatas, García, Nuevo León, Mexico. Photograph by Paola Elianne López-Villa.



Figure 2. *Gerrhonotus infernalis* captured by Paola Elianne López-Villa on the western side of the Sierra Nacatas, García, Nuevo León. This specimen was found within 15 m of the *G. lugoi* shown in Figure 1. Photograph by Paola Elianne López-Villa.



Figure 3. The locality where the lizards shown in Figures 1 and 2 were found. The vegetation can be characterized as low-growing desert shrubs. Photograph by Paola Elianne López-Villa.

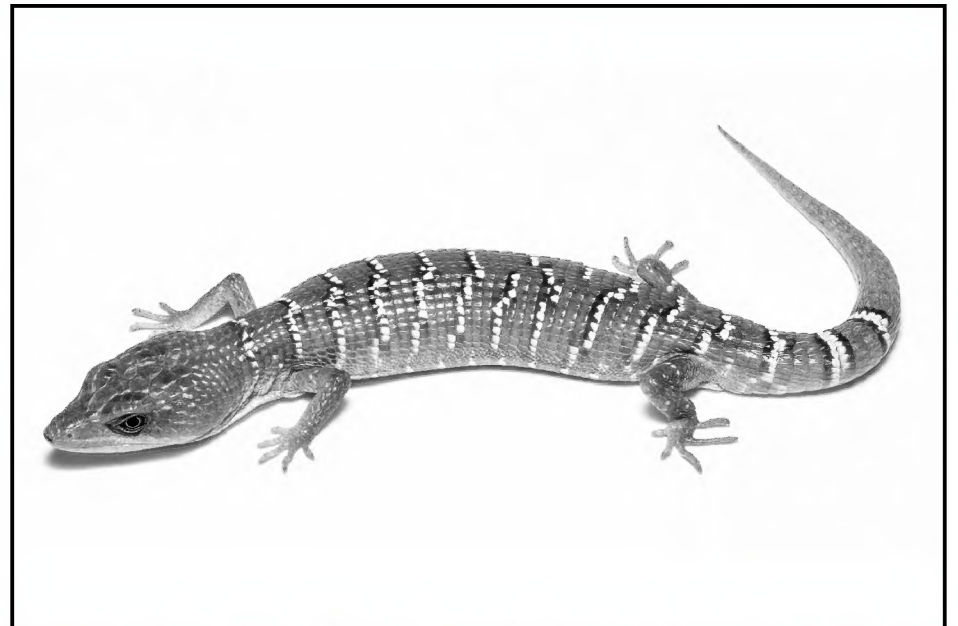


Figure 4. *Gerrhonotus lugoi* captured by Daniel Montoya-Ferrer along the road to San José de la Popa, Mina, Nuevo León, Mexico. Photograph by Daniel Montoya-Ferrer.



Figure 5. *Gerrhonotus lugoi* photographed *in situ* on a hillside along the road to San José de la Popa, Mina, Nuevo León, Mexico. Photograph by Daniel Montoya-Ferrer.



Figure 6. The habitat alongside the road to San José de la Popa, Mina, Nuevo León. Photograph by Edna Socorro López-Serna.

Results

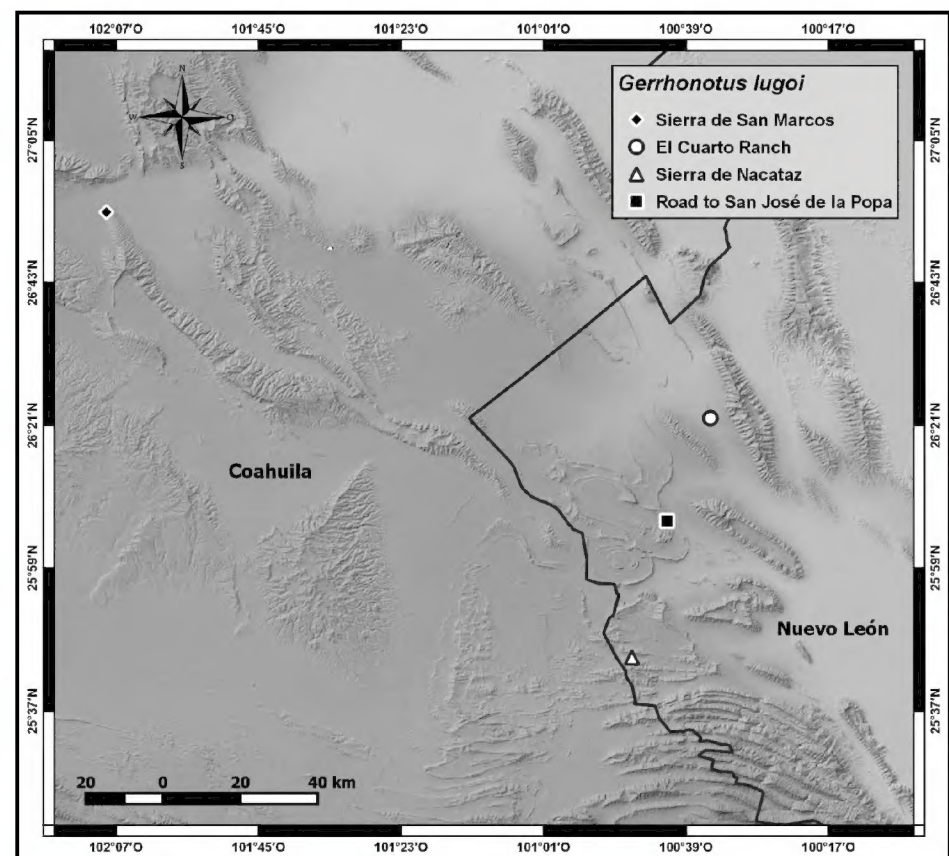
During a cactus rescue program on 25 July 2017 at 12:19 P.M., PELV discovered a specimen of *Gerrhonotus lugoi* (Figure 1) dwelling under a *Dasyllirion cedrosanum*. This locality is on the western side of the Sierra Nacatas, in the municipality of García (25°45'27.47"N, 100°47'20.29"W, WGS84; elevation 1236 m). The maximum altitude previously reported for this species was 800 meters above sea level (Lemos-Espinal et al., 2015). Under the same plant species, barely 15 meters away (25°45'27.95"N, 100°47'20.44"W, WGS84; elevation 1234 m), a Texas alligator lizard (*G. infernalis*) was found (Figure 2). The snout–vent length was recorded as 78 mm. Afterwards the lizard was released *in situ*. To our knowledge, this area (Figure 3) is the second locality in Nuevo León where *G. infernalis* has been reported to occur sympatrically with a smaller species of *Gerrhonotus*. The earlier report, in which the smaller species was *G. parvus*, was from Cañon de San Isidro, Santiago, Nuevo León, Mexico (Lazcano et al., 2015).

Based on the information above, a similar effort was performed in 2020 by DMF, searching in general for local herpetofauna. This resulted in the following observation of *Gerrhonotus lugoi* in the state of Nuevo León on the 26 April 2020. At 10:20 A.M. the lizard was observed on the slopes of a rocky hill alongside the road leading to San José de la Popa (26°6'25.50"N, 100°41'56.82"W, WGS84; elevation 768 m), in the municipality of Mina (Figures 4–6). When moving some dead leaves from an *Agave asperima*, a small lizard was seen seeking refuge in the lower leaves of the plant. However, it never reached the ground, but forced itself into the center leaves of the agave. The soil and the leaf surface were at 27°C; the weather was cloudy. The lizard was then photographed *in situ* and taken to the Laboratorio de Herpetología of the Facultad de Ciencias Biológicas of the UANL, for a positive identification. We immediately identified it as a male *Gerrhonotus lugoi*. In the lab we made the following measurements: snout–vent length = 92 mm; tail length = 65 mm; total length = 157 mm; weight = 12.82 g. In captivity the lizard passed a stool which was collected and analyzed. The stool contained the following invertebrate remains:

Family and Order	Genus	Identified remains
Acrididae (Orthoptera)	Not specified	Third tarsus
Formicidae (Hymenoptera)	<i>Pogonomyrmex</i>	Head; thorax
Tenebrionidae (Coleoptera)	<i>Eleodes</i>	Elytron
Termitidae (Neoisoptera)	<i>Tenuirostritermes</i>	Head

To our knowledge this is the first specific report of the diet of *Gerrhonotus lugoi*.

This observation also provides an indication of microhabitat selection. The area in which this lizard was found is, as mentioned earlier, characterized by low-growing desert shrubs, including several rosette form plants. Three *Agave* species are found there: *A. asperima*, *A. lechuguilla* and *A. striata*. Also present are *Dasyllirion cedrosanum* and *Hechtia parvifolia*. This specimen in particular was found under dead leaves of a dry and decomposing *A. asperima*, a relatively large century plant, even in death, reaching a diameter of more than 80 cm. It's also relevant and worth mentioning that this area in particular is very



Localities for *Gerrhonotus lugoi* mentioned in the text.

rich in desert lizard diversity. It is home to diurnal and active foragers like greater earless lizards (*Cophosaurus texanus*), eastern collared lizards (*Crotaphytus collaris*), blue-spotted spiny lizards (*Sceloporus cyanostictus*), canyon lizards (*Sceloporus merriami*), western marbled whiptails (*Aspidoscelis marmorata*) and rusty-rumped whiptails (*Aspidoscelis scalaris*). The microhabitat is also shared with Texas banded geckos (*Coleonyx brevis*). Lizard-eating snakes have also been sighted in the area, such as Texas nightsnakes (*Hypsiglena jani*), long-nosed snakes (*Rhinocheilus lecontei*), and rock rattlesnakes (*Crotalus lepidus*).

Discussion

Microhabitat selection

An association with agaves has been observed and documented in the state of Nuevo León for a wide range of native herpetofauna. Notable examples are the high-altitude-dwelling anguid, *Barisia ciliaris*, as well as the other gerrhonotids from the state (*G. infernalis* and *G. parvus*) being observed under two *Agave* species (Lazcano-Villareal and Pacheco-Treviño, 2015; Lazcano et al., 2015; Lazcano et al., 2018). The original description of *G. lugoi* mentions that most anguids don't fare well in arid habitats, however this factor of microhabitat selection may contribute to the survival of the species in xeric environments due to the moisture storage near the roots and base of the leaves as well as the thermal insulation provided by the *Agave* from the desert's scorching sun and relatively cold nights.

Range extension

These findings extend the currently known range of *Gerrhonotus lugoi*. The specimen found along RSJP is 32 km southwest from the first observation made in the state of Nuevo León by Garcia-Vázquez et al. (2016), in mostly the same conditions and in the same municipality. However, the specimen observed by PELV, extends the range even further southwest (40 km) to the municipality of García, and sets a new altitude record. While all previous observations of *G. lugoi* have been at less than 800 masl, the one from García was observed at 1234 masl, giving it access to other resources and microhabitats, as well as relations

with other possible predators. This observation also remarks the proximity with another and larger anguid, the Texas Alligator Lizard, which was observed merely 15 meters from the *G. lugoi*. This is remarkable due to the size difference; although *G. lugoi* is not the smallest member of the smooth-scaled group, it's significantly smaller than the larger, bulkier and keeled-scaled *G. infernalis*. Even if no direct competition between the species exists, at least some kind of predation events may occur in this particular area, as happens in Cañon San Isidro, Santiago, Nuevo León, Mexico (Banda-Leal et al., 2013), where *G. parvus* is the prey. Predation by *G. infernalis* on *G. lugoi* could be happening.

Acknowledgments

We would like to thank Manuel Salazar-González and Silvino Eduardo Hernández-Cardenas for helping us out on our collecting trips and our herpetological students for their work in the field and laboratory. We also are grateful to the local community members who now enjoy watching for and photographing members of the local herpetofauna and submitting their work to us so that we can report the results of that work and stop the slaughter of many reptiles.

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Notes on Reproduction of Cajun Chorus Frogs, *Pseudacris fouquettei* (Anura: Hylidae), from Oklahoma

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Abstract

I conducted a histological examination of gonadal material from 40 adult *Pseudacris fouquettei* from Oklahoma consisting of 33 males and 7 females. The *P. fouquettei* reproductive cycle commences in November and continues through the early part of the year. The two smallest males (sperm in lumina of seminiferous tubules) measured 22 mm SVL. The three smallest mature females (in spawning condition) measured 28 mm SVL. The presence of mature females (in spawning condition) and concurrent postovulatory follicles (from a recent spawning) in the same ovary (OMNH 23675) indicates that *P. fouquettei* females may spawn more than once in the same reproductive season.

Pseudacris fouquettei Lemmon, Lemmon, Collins and Cannatella, 2008 occurs from central Oklahoma south through central Texas and is found throughout Arkansas, Louisiana, southwest Mississippi and barely enters southern Missouri (Dodd, 2013). The newly described *P. fouquettei* has previously been called *P. triseriata*, *P. nigrita*, *P. feriarum* or *P. clarkii* in the literature (Dodd, 2013). Information on reproduction of *P. fouquettei* is summarized in Dodd (2013). In this paper I present data from a histological examination of *P. fouquettei* gonads from Oklahoma. Utilization of museum collections for obtaining reproductive data avoids removing additional animals from the wild.

A sample of 41 *P. fouquettei* from Oklahoma (Appendix) collected 1941 to 2019 consisting of 33 adult males (mean snout–vent length, SVL = 25.8 mm $\pm$ 1.8 SD, range = 22–28 mm), seven adult females (mean SVL = 28.3 mm $\pm$ 2.2 SD, range = 24–31 mm) and one unsexed juvenile (SVL = 18 mm), was examined from the herpetology collection of the Sam Noble Museum (OMNH), University of Oklahoma, Norman, Oklahoma, USA.

A small incision was made in the lower part of the abdomen and the left testis was removed from males and a piece of the left ovary from females. Gonads were embedded in paraffin, sections were cut at 5 μ m and stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber, 1997). Histology slides were deposited at OMNH. An unpaired *t*-test was used to test for differences between male and female SVLs (Instat, vers. 3.0b, Graphpad Software, San Diego, CA).

The testicular morphology of *P. fouquettei* is similar to that of other anurans as described in Ogielska and Bartmańska (2009a). Within the seminiferous tubules, spermiogenesis occurs in cysts which are closed until the late spermatid stage is reached; cysts then open and differentiating sperm reach the lumina of the seminiferous tubules (Ogielska and Bartmańska, 2009a). A tangled mass of spermatozoa or open sperm cysts was observed in the lumen of each seminiferous tubule. A ring of germinal cysts is located on the inner periphery of each seminiferous tubule. There was no discernible testicular cycle in my monthly samples of *P. fouquettei* males as all exhibited spermiogenesis (sperm formation): March (*n* = 14), April (*n* = 8), May (*n* = 9),

June (*n* = 2). The two smallest sexually mature males of *P. fouquettei* both measured 22 mm SVL (OMNH 41968, 44437). The majority of my samples are from early in the year during the reproductive period as *P. fouquettei* are rarely seen after the breeding season (Dodd, 2013). I cannot speculate when the one unsexed subadult (SVL = 18 mm) (OMNH 42526) would have reached adult size.

The mean SVL of *P. fouquettei* females was significantly larger than that of males (*t* = 3.2, *df* = 38, *P* = 0.0031). The ovaries of *P. fouquettei* are similar to those of other anurans in being paired organs lying on the ventral sides of the kidneys; in adults the ovaries are filled with diplotene oocytes in various stages of development (Ogielska and Bartmańska, 2009b). Mature oocytes are filled with yolk droplets; the layer of surrounding follicular cells is thinly stretched. Six of my sample of seven *P. fouquettei* females were in spawning condition in which mature oocytes predominated. They came from the following months: March (*n* = 1), April (*n* = 1), May (*n* = 2), June (*n* = 1), November (*n* = 1). My one female from October was not reproductively active and contained early diplotene oocytes in its ovary. The three smallest mature *P. fouquettei* females (spawning condition) in my sample measured 28 mm SVL (OMNH 23675, 41962, 43449). The presence of one *P. fouquettei* female with a quiescent ovary from October suggests the current spawning cycle had ended. My one November *P. fouquettei* female in spawning condition indicates the next period of spawning has started. November spawning has previously been reported for *P. fouquettei* in both Louisiana and Texas (Table 1).

None of my *P. fouquettei* females contained atretic follicles. Atresia is a widespread process occurring in the ovaries of all vertebrates (Uribe Aranzabal, 2009). It was seen in ovaries from females of the congener *P. streckeri* (Goldberg, 2020). The absence of follicular atresia in *P. fouquettei* females likely is due to my small sample size (*n* = 7).

Postovulatory follicles (evidence of a recent spawning) were noted in one *P. fouquettei* female in spawning condition from May (OMNH 23675). Postovulatory follicles form when the ruptured follicle collapses after ovulation; the follicular lumen disappears and proliferating granulosa cells are surrounded by a

Table 1. Months of breeding by state for *Pseudacris fouquettei*.

State	Breeding period	Source	Reported as
Arkansas	February to April	Trauth et al., 2004	<i>P. triseriata</i>
Louisiana	November to April	Boundy and Carr, 2017	<i>P. fouquettei</i>
Oklahoma	March to June	Bragg and Smith, 1942	<i>P. triseriata</i>
Oklahoma	March to June	Sievert and Sievert, 2011	<i>P. fouquettei</i>
Texas	November to April, May	Tipton et al., 2012	<i>P. feriarum</i>

fibrous capsule (Redshaw, 1972). Postovulatory follicles are short-lived in most anuran species and are resorbed after a few weeks (Redshaw, 1972). The presence of mature follicles for a subsequent spawning, with concurrent postovulatory follicles from a recent spawning, in the same ovary indicate *P. fouquettei* may spawn a second time during the same reproductive period as has been reported for the congener *P. streckeri* by Goldberg (2020).

In conclusion, the *P. fouquettei* reproductive cycle commences in November and continues through the early part of the

year. As was reported for the congener *P. streckeri* (Goldberg, 2020), the occurrence of mature follicles (imminent spawning) and concurrent postovulatory follicles (from a recent spawning) in the same ovary is evidence that, *P. fouquettei* females may spawn more than once in the same reproductive period.

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Appendix

Forty-one *P. fouquettei* from Oklahoma examined (by county) from the herpetology collection of the Sam Noble Museum (OMNH), The University of Oklahoma, Norman, Oklahoma, USA. **Atoka:** OMNH 39106, 39822, 39823, 41959-41967; **Cherokee:** OMNH 27268, 48235; **Cleveland:** OMNH 38137; **Haskell:** OMNH 43433; **Le Flore:** OMNH 41968, 43434, 43444, 43445, 43447, 43449, 44436; **McCurtain:** OMNH 22910, 23671, 23675, 30885, 30892, 48128-48131; **McIntosh:** OMNH 42526; **Muskogee:** OMNH 39599, 39616, 39617; **Oklahoma:** OMNH 44437; **Sequoyah:** OMNH 47858-47860; **Tulsa:** OMNH: 23228.

The Yuma Experience: Flat-tailed Horned Lizards (*Phrynosoma mcallii*) and 'Winders as Common as Sand — Part 1

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Author's note: The article that follows is based on an article that I wrote for the Tucson Herpetological Society (THS) over 23 years ago. The narrative has changed, but the story behind the words remains the same. The opportunity to add photos to go with this adventure did not exist when the article was initially published. As a courtesy to the THS, the author sought and received permission to write an abridged version of this article. Part of that process involves formally citing the original article, and sending a copy to the THS. Both will cheerfully be done in due course. Please refer to the Acknowledgments and Literature Cited sections below. Having temporarily dispensed with the formalities, it's time to rock!

The evening of 30 July 1994 found this author wandering back and forth between a building and his vehicle. In his hands he held a printout of an email, and on his face he wore the look of confusion that is his trademark. The email in hand described a building much like the one before him, but his knockings upon the door were going unheeded. The fact that he had arrived here two hours early might have had something to do with the unanswered knocking, but the possibility also existed that he might be in the wrong place. The third trip to the door was the charm. Rather than laying waste to his overburdened knuckles again, the doorknob was tried. Said doorknob turned efficiently in his hand and, as is the normal situation when a doorknob is rotated in clockwise fashion, the door swung open.

Blinking stupidly in the threshold of the door stood he, wondering what his next move should be. For all he knew, somebody could be aiming a pistol on the centerline of his profile *right now*, with rightful intentions of blasting him into the middle of next week. He was, after all, in Yuma, Arizona—where men are men and trespassers are shot. And he was about to enter a building without being invited to do so. With thoughts of high velocity holes being drilled into his person, he determined that perhaps the gift of speech should be applied.

"Hello? Anybody here? Don't shoot—friendly Roger approaching!" No answer.

It was time to mosey inside and take a look about. If my



Figure 1. Fit and trim in mind and body, and a lioness in spirit, the future Dr. Wendy L. Hodges poses behind a Sidewinder (lower left corner) that she has just found on one of her study grids. Wendy was surveying areas to the south and east of Yuma for Flat-tailed Horned Lizards when this Sidewinder was found. And were the Sidewinders as common as sand, as Wendy had suggested? Almost! See text for details. Image by the author, 1 August 1994.

directions were correct, I was standing in the bunkhouse of the Arizona Game and Fish Department's Yuma Regional Office. Further investigation of the sturdy building's interior reflected that I might indeed be where I should be. Various stuffed, mounted heads adorned the perimeter of the upper wall of the room that I was entering. Glassy, angry eyes glared at me from every angle possible, here a bighorn sheep, there a mule deer, a snaggle-toothed javelina, a snarling mountain lion, a howling coyote. There was just enough space left on one of the walls for my head, should one want to display such a ghastly sight. Nobody but an idiot would continue to enter this room, which was why I did exactly that. In addition to the stuffed heads—which I swear were watching me as I progressed further in—there was a table with six chairs, a couch, and a few other thrift-store chairs scattered about. A laptop computer was cracked open on the table, showing signs of recent usage. I traveled the length of the room, and entered a narrow hallway. Perhaps 20 feet away, straight ahead of me, stood an open door entering a darkened room. A humming coke machine stood against the wall near that door. To my left was another door, which was cracked slightly

ajar. A light was shining through the crack. It was then that I heard water running from behind it. My early arrival had allowed me the privilege of catching the woman whom I barely knew, one Wendy Hodges, in the shower!

What does a gentleman do when he catches an unaware female counterpart in the shower? A quick check of the guidelines laid out in my pocket copy of "Emily Post" revealed no information for such a situation. It was time to break new ground, and hope that my course of action was proper. I knocked on the door and said "Wendy, is that you in there?" There was some hesitation, and then, a terse response: "Yes, who's there?" (At that point, I could only imagine what was going on in Wendy's mind. Perhaps scenes from the famed Alfred Hitchcock movie *Psycho*? But I don't believe that Anthony Perkins knocked before exhibiting knifing behaviors). "It's me, Roger. Sorry I got here so early." "That's okay, I'll be out in a minute." "I will avert my eyes for you then." I dutifully wandered back into the room with the mounted heads, and stuffed my face into the only corner that would allow Wendy

egress without being in my line of sight. Standing with my nose pressed into the right-angled wall corner brought back fond grade school memories, where, at the behest of my teachers, many an hour was spent admiring the finer details of wall structures. As one who considers himself an expert in such matters as wall junctures, countless hours of personal observations lead me to say that this corner was one of the best ever. It was perfectly square, of solid build—as fine a corner as I have ever smashed my face into. And that’s saying a lot! Standing in this particular corner also gave me time to reflect back on the events that had led up to this moment.

In May of 1994, Wendy had presented her work on Flat-tailed Horned Lizards (*Phrynosoma mcallii*) to the THS. I confess that my pre-presentation attitude was one of total apathy, but to her credit, Wendy came down from Phoenix and knocked our collective socks off with an outstanding summary of her work with the FTHL. (They will be called FTHL often throughout this article.) So impressed was I with this presentation that I sent a personal letter of thanks along with the customary T-shirt that those who brave our arena receive. I included a business card with this thank-you note, not even realizing that my email address was on that card. Several days later, I received an email from an unknown address, which carried the prefix `iffp475@...`, and was delighted to see that it was a message from Wendy. It was the very first email that I ever received from anybody outside of the place that I worked. And a new era began. Just like *that*, I morphed from a highly productive machine shop supervisor into a worthless herp geek who did little else but email his friends all day long. The transition was swift—and it started right there!

With the high tech connection made, several emails were fired back and forth. (See what I mean? When I *should have* been cutting metal for the science of astronomy, I was diddling around writing my new friend Wendy.) In one missive, I told Wendy that she should come to Tucson to view some of my montane herping spots. I told her of a land flowing with Ridgenosed and Rock Rattlesnakes, where Mountain Kingsnakes could be picked like fruit from vines, and Mountain Treefrogs sang their night music like opera stars. Wendy chose to ignore this mild hyperbole, and instead mentioned that her only real herpetological interest in Arizona was finding a Regal Horned Lizard. My response to this was “Yegads girl! I tell you of a land flowing with ridgenose, and you want to see horny toads? I find *them* in my driveway!” But when I mentioned my love of Sidewinders, she informed me that “they were as common as sand” on her study plots. Was there *really* a place where ‘winders are as common as sand? If so—sign me up for *that* duty, dudess! She did, and that was why I was now closely monitoring a wall juncture, when I could have been angling for a peek.

Wendy eventually entered the room, fully dressed, and released me from my corner duty. She greeted me with a firm handshake, and sat me down in front of her computer where she showed me some pretty dots of light on her screen. I displayed my scientific brilliance by saying “Jeez Wendy, they look like Christmas tree lights to me.” The full realization of who she was dealing with suddenly became clear to her, and she laughed at my little joke. (Had I listened to Wendy’s presentation with just

a tad more focus, I would have known *exactly* what she was showing me. She had just downloaded more than one hundred GPS waypoints onto her computer, each waypoint being the location of either a horned lizard or, more likely, one of its scats. Had I known at the time what I know now, I would have known where over a hundred horny toad turds had been found that morning.)

She then proceeded to inform me that she didn’t think that she could take me to her plots, due to the secretive monitoring techniques that she had developed. (It was at this point where my mind was screaming “*WTF?* You mean to tell me I just traveled 150 miles for *nothing?* I got news for you, lady—we’re going to your plots—even if I have to drag you!”) But I of course said nothing of the sort. The foot-kissing process began in earnest. At first, I thought that she was afraid that I would go back to her spots to collect Flat-tails, and began to earnestly promise her that I would *never* do such a thing. My misguided babbling in that regard seemed to do something, for she gave me a smile, shook her head a bit, and agreed to let me tag along the next morning. But she had two edicts that she laid on me. The first was that when she was walking her grids, I was to remain behind her, stay quiet, and *not* bias anything she was doing. She was basically telling me she didn’t want me finding anything on those grids, as the dizzying statistics behind the number and location of horned lizard scats only allowed for one person searching. (Heaven only knows how disastrous it would be to the science of FTHL surveys were I to see something that Wendy missed.) Upon hearing this edict, it was my turn to smile and shake my head. Roger Repp—the future Herp King of Southern Arizona—not being allowed to find anything? How ridiculous! That sort of defeated the purpose of my being there. The second edict was that I was *not* to reveal anything of her monitoring protocol. This suited me just fine, since none of my friends would care in the least about how to go about finding and documenting horned lizard shit! When I told her this, Wendy explained the reason for the cloak-and-dagger grid walking that I was about to witness.

In 1994, the FTHL was a candidate species for listing under the provisions of the Endangered Species Act (ESA). Once a herp—or any other animal or plant—is either listed or about to be listed, there is often big money involved in researching it. An animal like the Flat-tail can and does attract the fiscal interest of various institutions, who in turn hire teams of environmental consultants to either prove or disprove whatever the institution paying them *wants* to prove or disprove. Like everybody else, there are good and bad environmental consultants. There is a word for the bad ones, and that word is “biostitutes.” Again, we speak only of the bad ones when we say that they are basically science for hire. Give them a bag full of money, and they’ll say what you want to hear. Wendy had recently learned that some of these biostitutes were working in her vicinity, and getting paid over \$100 per hour to do the same thing as she was doing. They made more money in a week than she made for her entire project! And this is the perfect segue into what Wendy *was* doing at this stage in her life. She was working on her Ph.D. in zoology at the University of Texas at Austin. Her advisor was the famous lizard ecologist Dr. Eric R. Pianka. She was being paid through a grant received from Arizona Game and Fish to survey Flat-tail



Figure 2. (Left): The Flat-tailed Horned Lizard (*Phrynosoma mcallii*). (Right): Goode's Horned Lizard (*Phrynosoma goodei*). These are the two species of horned lizards found near Yuma, Arizona. As the images indicate, these two lizards are quite different in appearance, yet amazingly similar in diet and habits. Images by Randy Babb (left) and Jim Rorabaugh (right).

populations in Arizona.

At the time of Wendy's earlier-mentioned presentation to the THS, all such programs were recorded and transcribed for future publication in the *Sonoran Herpetologist*, which was and still is the newsletter for the THS. The follow-up article of her presentation, published in February of 1995, is in front of me as I write what comes next. By the time it was published, there was no longer any need for secrecy about her methodology. As her marital circumstances changed between then and now, the reader needs to be aware that her last name was Donaldson during our earliest associations. She has since been Hodges to me for so long that it seems a sacrilege to use that other name. Since I am about to paraphrase all that comes next from a single source, I will note that source at the end of the next paragraph. And the name on that citation is Donaldson.

In 1994, there were two recognized species of horned lizards inhabiting the southwest corner of Arizona. Those two were Flat-tailed Horned Lizards (*Phrynosoma mcallii*) and Desert Horned Lizards (*Phrynosoma platyrhinos*). For reasons unclear to this author, *P. platyrhinos* has since been split into two species, and those near Yuma are now called Goode's Horned Lizards (*Phrynosoma goodei*) (Figure 2). Flat-tails also occupy parts of California and Mexico, but Wendy's presentation focused strictly on Arizona. While many factors were causing problems for the FTHL here, the principle danger was (and still is) habitat loss. Wendy needed first to establish where exactly the Flat-tails were in Arizona, and once she knew that, she had to do her best to discover where the highest population densities were located. To accomplish this, she scattered 35 different, four-hectare plots in known habitat. Simply put, a hectare occupies roughly the same area as two football fields laid side by side. Hence, each of her plots encompassed eight football fields in area. Stakes with flagging, each carrying a number, were driven into the ground at exactly ten meters apart. Since the lizards themselves were only rarely seen, she instead focused on finding their scat. To paraphrase her words, the Flat-tail scat "is packed with ants, has a unique elliptical shape, are very shiny, and have a dab of uric acid at one end. They are often called jewels of the desert." (In my own words—Hell yeah! They are the most beautiful turds in the world. How I wish we humans

crapped as pretty.) Once Wendy located one of these scats, the exact location would be noted in relation to the numbered stakes. The scat would then be removed, so that it would not be counted again. Soil samples and vegetation were also taken. There is of course much, much more in this article, but the basics of what I was about to see in the days ahead have now been described. If you want to know more, see Donaldson (1995).

Getting back to 30 July 1994, after a bit of small talk, it was time to turn in. Here is where another surprise awaited me. I was shown a little room with two beds in it. One of these beds was to be mine, and when questioned as to who would be sleeping in the other one, Wendy replied "me." Hopefully, a poker face was displayed in art form, but my first thought was "how in the world am I going to explain this to my wife?" And here were Dianna's thoughts when I *did* explain the situation to her: "Roger, don't you realize that Wendy is basically working in a man's world? It is a highly competitive field, and the only way for her to be accepted in this man's world is to forget any gender issues." Very understanding woman that I've got there! Nevertheless, as I looked upon the scene that was about to unfold, Mr. Smoothie here blurted out the thing that concerned him most about sleeping in the same room with this "strange" woman. "I gotta warn you Wendy, my feet smell like dead things!" Charmed by this seduction, Wendy laughed and said "That's okay, I snore." And so to bed we went, my feet smelling of dead things, Wendy snoring away, and we got along just fine. She even told me I could close the door to our bedroom, but no sir, even though we were sleeping in the same room together without any chaperones, I would not shut that door! This was my age of innocence when it came to working with female wildlife biologists.

At four o'clock the following morning, Wendy gave me the "off your arse" poke that indicated it was time to move. I leapt alert and said "All Right! 'Winders common as sand. Let's go!" She had yet to learn of my all-out enthusiasm when doing anything of a herpetological nature, but seemed pleased with the wide-eyed exuberance. We packed our gear and whistled off into the darkness in her Ford 150 4WD pickup truck. We immediately found a Woodhouse's Toad (*Bufo woodhousii*) on a paved road near the bunkhouse, and gave pause for long enough



Figure 3. Woodhouse's Toad (*Bufo woodhousii*) found near Yuma in the early morning hours of 31 July 1994. While other toad species have been completely extirpated along the Lower Colorado River, *Bufo woodhousii* seems to holding steady. One reason for their success is that Bullfrogs—which are disastrously common here—do not appear to be eating them.

for me to photograph it (Figure 3). As the first streaks of dawn painted an azure sky, we arrived at our first stop—grid number 32. Whoops! Now I've done it! Now the whole world knows where we were this day. And I suppose if I tell you all that grid #32 was in between #31 and #33, I will have exposed too much?

As we walked the short distance from the truck to the grid, Wendy patiently endured my excited babbling. I can't repeat what I was saying word for word, but it all went something like this: "Whoa, here's a big one!" I exclaimed while pointing out a Sidewinder track. "Look, he's going this way. Just follow the J's and, whoa, here's another one! A dinky guy, look, here's where he cratered for the night, he must be in that hole! He *is* in that hole, look, see where he crawled in? I'll bet he's in there right now. What the hell is this? What makes those tracks, Wendy? Is that a Shovel-nosed Snake track? Holy mackerel, there's two more, no, three more! And they pay you to come out here?" (Previous to this fantastic moment in time, I had been tracking various snakes to their lairs in the Tucson area, but the successes had been limited. The tracking is *far* more difficult near T-town, as the soil is harder packed, and there is *way* more vegetation disrupting the effort. In regards to the local Sidewinders, I had tracked a grand total of two of them to their lairs—in five years of trying! That N of two was about to change dramatically).

By this time, Wendy began walking between some lines of flagged stakes that were laid out in a grid across the desert floor. Said stakes were made of spring steel wire, perhaps 0.032 inches in diameter. They were somehow moored into ground in such fashion as they stood roughly 18 inches proud of the surface. The flagging was bright orange in color, roughly 1½ inches square. On each flag a number was written, said number doubtless meaning something important in terms of its location on the grid. Since everything was a big damn secret, I didn't ask any questions. Once Wendy began walking her grid, as instructed, I fell in step behind her. And as instructed *not to do*, my mouth was flying a mile a minute over my many great discoveries. And then, the next thing I knew, I was looking at a neonate Sidewinder that was 'winding with great haste toward one of the

many holes in the sand. "Wendy, I got a 'winder here! Check it out, this is too cool!" About this time, Wendy turned to give me a look that plainly said: "Shut up!" That was when I realized that my observations should be kept to myself. In silence, I went down to one knee to photograph the little 'winder. This snake was a personal triumph for me, for it marked the first time that I had ever seen a surface-active Sidewinder moving about diurnally. My camera was aimed and ready to fire. I pushed the shutter button—and absolutely *nothing* happened! I looked at the digital dashboard on my camera, which informed me: "Congratulations! Your battery just died." How convenient! This in turn caused a cascade of salty language. Of all times to be without a camera, this was *not* the time!

The little 'winder shot down one of the many rodent holes in the vicinity, and was gone from my life a split second later. With much mumbling and cursing of bad fortune, I backtracked the tiny thing, and my suspicions were confirmed. Wendy had stepped very close to where the snake had been cratered, causing it to streak into the sheltering hole. She had spooked *my* Sidewinder! She blew by a snake because she was looking for what? Horny toad turds! It was here that a haughty decision was made, and said decision was that I wasn't born to follow turd-seeking college kids. And being restricted to walking straight lines on her grid was *boring*! Aware that my presence on this patch of ground could be short-lived if I didn't behave myself, I nevertheless made an executive decision: I was going to wander off-plot to do my thing alone. Expecting a call back to protocol from she who *must* be obeyed (what a cruel world it can be—college girls bossing *me* around?) I meandered off course. I breathed a huge sigh of relief when no "get thee back in line" commands were issued by my new herp buddy. Perhaps Her Highness was thankful to be rid of me? Good! And vice-versa even!

Having been granted such freedom, I threw myself into the fray with an exuberance that I have never felt before—or since. There is nothing more noble or exciting to this herper than reading the stories in the sand. No lies had been told, the Sidewinders were, when compared to any other place I had ever been, as common as sand in the area. Occasionally, I reminded myself that I should get my nose out of the sand for long enough to note my surroundings. The terrain could best be described as flat and featureless, save for the distant, incredibly steep and jagged basaltic mountain formations that thrust themselves helter-skelter in the distance any which way one turned. The primary ingredient of the landscape was a fine, soft, tawny-colored powdery sand. As far as the eye could see, in every direction, there was sand and more sand. Scantly dispersed about the sand were those shrubs that could survive the harsh and terribly dry climate that is indicative of the Yuma Desert. Stunted, twisted creosote bushes, white bursage and the crotch high big galleta grass were the dominant plant forms. The sea of sand was also punctuated by the occasional patch of stubbly sticks or tenacious, drab-colored tufts of grass. It was basically a landscape comprised of various shades of olive drab, tan, shadows, bright sun and deep blue skies (Figure 4).

Scattered about the base of each creosote bush was an impressive network of small burrows, ranging in size from insect refugia to larger affairs dug by badgers or foxes. Indeed, the



Figure 4. A pristine swath of the Yuma Desert, home to the Flat-tailed Horned Lizard and scads of Sidewinders. This image was taken in June of 1991 by Dale S. Turner. With the recent addition of an interstate highway and a border wall in the vicinity, the author can only hope that there are still places like this remaining near Yuma.

burrow networks surrounding the creosote bushes were so vast and complex that on approach, the ground would collapse beneath me, and I would plunge knee-deep into the sand. It was in these areas that the sidewinder tracks were the most numerous. Some of the holes pock-marking the creosote bushes had several various-sized craters left by Sidewinders. It appeared that these holes contained aggregations of several Sidewinders (Figure 5). On and on I went, closely scrutinizing the ground before me, reading the stories in the sand, trying to imagine what the place must be like after dark. The smaller clumps of grasses and stubby sticks that thrust out of the sand appeared to be the favored foraging places of Shovel-nosed Snakes (*Chionactis annulata*), for their faint, lazy-S shaped tracks centered around these areas. Since other tracks, like those of the desert cockroach, swirled about in these areas, it was my best guess that the Shovel-nosed Snakes must have been zeroing in on these.

Wendy gave me a yell that indicated she had found a Sidewinder. She inscribed a circle with her walking stick around the snake, and continued her flag walking. I ran to the scene, and found her 'winder "cratered" in the soft sand (Figure 6). I bent over for closer examination, and the snake suddenly exploded from its crater, and took off after me, launching aggressive strikes at both of my rapidly back-peddling feet. As soon as I got out of its way, it blazed into one of the many nearby holes in the sand. I had made the classic mistake of putting myself between the snake and its shelter, and was rewarded for such errant thought patterns with the full wrath of the testy snake.

Shortly after that, the lizards became active. Zebra-tails (*Callisaurus draconoides*) streaked across the sandy substrata, Common Side-blotched Lizards (*Uta stansburiana*) did their pushups in the shade of the creosote, and I got a glimpse of a very swift-moving Desert Iguana (*Dipsosaurus dorsalis*) beating feet away from me. The sighting of the *Dipso* was the last event to happen on Plot 32, for it was then time to move on to another plot. We piled into the truck and wove our way through a most confusing maze of roads. Even while being propelled by her massive four-wheel-drive Ford F150 Republican-mobile pickup truck, it appeared that we were in danger of getting stuck in the loose sand of the roadways. Wendy blazed down these roads at top speed, in a form of controlled skid, for the whole distance.



Figure 5. Is anybody home? This author thinks so! Sidewinder tracks like these abounded around the small mammal holes near the bases of creosote bushes. Image by the author, 1 August 1994.

We got one look at a lizard that was either a Yuman Desert Fringe-toed Lizard (*Uma rufopunctata*) or a FTHL, but even though we surrounded the vegetative complex that it ran into, we never made a positive identification.

The second plot visited on this day was Plot 30. There were far fewer 'winder tracks here, but I did manage to get four tracks of larger snakes. The tracks were over an inch wide, nearly ramrod straight, and led well off into the distance. The sand here was so excellent at retaining detail that the individual, caterpillar-like impressions of a rib-walking snake could clearly be seen at both edges of each track. I am guessing these tracks were either those of Western Diamond-backed Rattlesnakes (*Crotalus atrox*), or Mohave Rattlesnakes (*Crotalus scutulatus*). Upon approaching a creosote bush in this area, I observed the dorsal view of a Flat-tail dangling from one of the branches. Upon walking around to view the front of the lizard, my visual senses were assailed by the cruel hunting techniques of the world's most vicious songbird, the loggerhead shrike (*Lanius ludovicianus*). The lizard was slashed upward from gut to gizzard, with various forms of entrails dangling from the open gash. It had been impaled in merciless fashion between the head and



Figure 6. A perfect example of what is meant by the word "crater" as it pertains to a Sidewinder ambush-hunting posture. The snake will coil flush or even below flush in the soft sand the evening before, and often remain there until well into the following morning. Should a small rodent or lizard wander too close, the snake will explode from the crater with a lightning-fast strike. Image by Jim Rorabaugh.



Figure 7. (Left): A loggerhead shrike. (Center): Dorsal view of a shrike-impaled Flat-tail. (Right): Ventral view of the same lizard. See text for details. Left image by Ned Harris, center and right by Wendy L. Hodges, 31 July 1994.

left shoulder on a sharp stick protruding out of one of the branches. The lizard's left arm was draped over the branch itself, and the look on the unfortunate lizard's face was almost comical to behold. It seemed to have died with a sneer on its visage, as if it were saying "Go ahead you big, dumb bird, you can't hurt me... GAAA!" The sneer was its last great act of lizard defiance. It was a ghastly but courageous sight to behold (see Figure 7).

I grabbed my camera, began to set up the shot, and then the painful memory that I did not have a functional camera took hold. More curses transpired, and I began the process of reshaping my forehead by slapping it repeatedly with the palm of my hand. Muttering to myself in earnest, I meandered over to the edge of Wendy's grid, waited respectfully for her to come to me, and told her of what I had just found. Apparently, this sort of interruption was allowed. Fortunately, she had a camera that worked, and she was more than willing to take a break from her turd-watching to photograph the moment. The two slides of this event now in my slide library (thanks to Wendy) are among my most prized slides of animal behavior. It is also good that Wendy took the time to photodoc the occasion when she did, for an hour later, the bird had returned unseen to claim its prize.

As I bring Part 1 of this adventure to a close, let me make one thing *perfectly* clear. This trip to Yuma was one of the most exciting herp adventures I have ever participated in. I can't believe that I have waited this long to write this column for the CHS. While I have poked some fun at Wendy in this piece, this trip obviously could not have happened without her. I would be remiss if I did not express my heartfelt gratitude to her for not only handling a somewhat awkward situation with grace and finesse, but also managing to be good company in the process. I was at her mercy with this visit, and she was benevolent enough to cut me a *lot* of slack. I worked closely with Wendy for the

next eight years, and the longer I knew her, the more impressed I became with her both her intellect and maturity. By the time she received her Ph.D. she was widely respected for her vast knowledge of *all* species of horned lizards—not to mention many other forms of lizards, amphibians, insects and plants. I was walking in tall cotton any time that I was walking with Wendy Hodges.

While the near future held some living Flat-tails for us (this and more will be related in Part 2 next month), the dead one dangling from the creosote branch remains the only FTHL that this author has ever personally "hiked out." Since that time, many of the places that we visited have fallen to the explosive population growth of Yuma. As much as writing this article has inspired me to return, I prefer instead to remember it the way it was back in 1994. And besides, *anybody* can find a living Flat-tail. It takes a master to find an eviscerated one gaily festooned to a creosote branch.

This here is Roger Repp, signing off from Southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are above average.

Acknowledgments

First and foremost, I am grateful to Dr. David L. Hardy, Sr., who was the editor of the *Sonoran Herpetologist* (SH) in 1994, for his willingness to publish the initial version of this article. We miss you, Dave. Robert Villa, president of the THS, and Howard Clark, the current editor of the SH, were quick to enthusiastically bless the effort to rewrite this piece. Jim Rorabaugh is always quick to send me images on request. We will see far more of Jim in Part 2 of this effort. A last shout-out goes to Steve Barten, who always provides cheerful assistance in *trying* to make my images passable enough to publish.

Literature Cited

- Donaldson, W. L. 1995. Conservation of the flat-tail horned lizard (*Phrynosoma mcallii*) in Arizona. *Sonoran Herpetologist* 8(2):12-14.
- Repp, R. 1997. A place where 'winders are common as sand—more than just horny toads. *Sonoran Herpetologist* 10(4):37, 39-44.

Herpetology 2021

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

LONG-TERM MEMORY IN MONITOR LIZARDS

T. L. Cooper et al. [2020, Journal of Herpetology 54(3):378-383] note that procedural memory allows animals to solve previously encountered tasks over weeks, months, or years efficiently. Although well documented in vertebrates such as mammals and birds, studies of procedural memory in squamate reptiles are lacking. Filling this gap in knowledge is important to understanding the degree to which procedural memory is unique to birds and mammals, as it is related to their unique cognitive abilities. The authors tested for memory of a problem-solving task in two species of monitor lizard (*Varanus* spp.) and a beaded lizard (*Heloderma* sp.) after a 20-mo hiatus in exposure, representing approximately 25% of their ages at the time of testing. All the monitor lizards had lower initial latencies to solve the task upon re-exposure posthiatus than they had as naïve individuals during the prehiatus trials and reached minimum latencies in fewer trials than when previously tested. These results indicate procedural memory of puzzle-solving behaviors on the time scales of years. The results add to an emerging literature suggesting that squamate and other nonavian reptiles share a number of cognitive traits with birds and mammals, suggesting that such traits are far more widespread across taxa than previously recognized. The authors also discuss a framework for studying cognition in squamates that would allow tests of cognition across a great diversity of body forms and ecologies.

BARBOUR'S MAP TURTLE IN FLORIDA

J. D. Mays and E. P. Hill [2020, Chelonian Conservation and Biology 19(2):155-164] collected information to determine the status of Barbour's map turtle (*Graptemys barbouri*) in Florida by conducting standardized surveys of occupied watersheds in 2014–2015, including the Choctawhatchee, Chipola, Apalachicola and Ochlockonee rivers. Single-pass basking surveys were used to determine the distribution and relative abundance of *G. barbouri*. Multiple-pass basking surveys were used in sections of the Apalachicola and Ochlockonee rivers to estimate detectability and abundance of map turtles. Observed counts were compared with available information from previous surveys to make inferences about population change. A total of 5917 *G. barbouri* observations were recorded during single-pass surveys along 502 river kilometers (rkm) and they expanded the documented range by 76 rkm. Further, the authors used multiple-pass surveys to estimate 2079 *G. barbouri* along six 2-km sections (12 km total) of the Apalachicola River (173.3 turtles/rkm) and 292 *G. barbouri* along five 5-km sections (25 km total) of the Ochlockonee River (11.7 turtles/rkm). The present study is the most comprehensive distributional survey for *G. barbouri* in Florida to date. The species was documented for the first time in two counties and observed counts were consistently higher than in previous surveys. Overall, the Florida population appears secure with evidence of expansion in both the Choctawhatchee and Ochlockonee drainages.

HOMING BEHAVIOR IN THE RUBÍ POISON FROG

L. F. Arcila-Pérez et al. [2020, Copeia 108(4):948-956] note that homing is a behavior in which an animal returns to a specific place after they have moved or migrated to a distant place. In anurans, most of our knowledge about homing comes from studies in temperate-region species with nocturnal activity and reproduction associated with ponds. Recently, studies with poison frogs (Dendrobatidae) have increased our understanding about homing in tropical frogs with diurnal activity, and that do not breed in large ponds. Rubí poison frogs, *Andinobates bombetes*, offer a good opportunity to further increase the knowledge of behavioral ecology of homing in anurans because some natural history traits in this species differ from those exhibited in most poison frogs in which homing ability has been studied. For instance, *A. bombetes* have a smaller body size and use phytotelmata in bromeliads for tadpole development while others use terrestrial pools. To quantify the homing ability and the factors influencing it in *A. bombetes*, the authors performed translocation experiments of individuals at distances of 5–90 m outside their territory in a forest remnant located in the department of Quindío, Central Andes of Colombia. They included a large sample size of females, which is important because homing in poison frogs has been almost exclusively studied in territorial males. Of 104 displaced individuals, 39 returned to their territory. The probability of homing in *A. bombetes* was negatively related to the translocation distance, but was unrelated to body size and sex. Apparently, this species has a limited homing ability when compared to most poison frogs studied so far except for *Oophaga pumilio*, which seems more similar in body size and resources used for reproduction. Overall, homing ability appears to be widely shared in the family Dendrobatidae, *Andinobates* being the fourth genus of this family for which homing ability has been corroborated experimentally.

URBAN TURTLE PROJECT

A. T. Coleman [2020, Chelonian Conservation and Biology 19(2):283-290] notes that long-term data sets are critical in assessing populations of long-lived species such as turtles. The Urban Turtle Project was initiated in 2018 to begin building a long-term data set on the demography and ecology of the turtle populations in various urban waterways of Birmingham, Alabama. Another goal of the project is to increase public awareness of the state's impressive chelonian diversity by employing citizen scientists on semiannual sampling weekends. In its 2-yr existence, 52 participants volunteered over 200 hrs during four sampling weekends, with 16 volunteering for multiple weekends. Over 200 turtles of 10 species were sampled, with the majority of captures ($n = 83$) being Alabama map turtles (*Graptemys pulchra*), a historically understudied species. Collected demographic and reproductive data contribute to a better understanding of natural history of *G. pulchra* and how this and other species exist in an urban environment.

GESTATION SITE TRADE-OFFS

M. W. Herr et al. [2020, *Journal of Herpetology* 54(2):196-205] note that trade-offs can cause conservation measures designed to improve habitat for one aspect of a species life history to inadvertently decrease its suitability in other ways. The authors explored the potential trade-off between thermal characteristics and risk of predation in important habitat for timber rattlesnakes (*Crotalus horridus*). Although typically a woodland species, pregnant *C. horridus* congregate in sunny, rocky clearings known as gestation sites that provide improved thermal habitat for embryonic development. Gestation sites can become overgrown with vegetation and, thus, sites may vary in canopy openness. The authors hypothesized that gestation sites with more canopy openness will be warmer but leave the snakes more exposed to predators. They used hemispherical photography to calculate canopy openness and operative temperature models to quantify thermal quality. Rattlesnake foam models and time-lapse cameras were deployed to quantify the relative predator richness and risk of predation. It was found that more-open gestation sites were warmer than enclosed sites, and that potential for predator encounters was similarly common regardless of gestation site canopy openness. However, the authors did find that predator species richness increased with canopy openness, with the most dangerous predators (raptors, mustelids, and felids) being only present at the most-open gestation sites. These results suggest that conservation actions for *C. horridus* that involve opening up the canopy at existing gestation sites may have unintended fitness consequences, as more dangerous predators appear to visit these more-open sites.

SCENT-TRAILING BY NEWBORN RATTLESNAKES

C. A. F. Howey and E. M. Snyder [2020, *Copeia* 108(4):772-777] note that animals can obtain social information from monitoring chemical cues in their environment left behind by conspecifics, competitors, predators, or prey. Whereas many studies have addressed the ability of snakes to trail scents in the laboratory along a homogeneous substrate (i.e., butcher paper), the authors' objective was to determine if the scent-trailing behavior of a snake was affected by changes in substrate type (paper, sand, leaf litter, and burnt leaf litter). They brought five pregnant timber rattlesnakes (*Crotalus horridus*) into the laboratory where each gave birth to an average of nine newborns. After each newborn shed, a Y-maze trial was conducted. The scent of the mother was applied down one arm of the Y-maze. Each newborn was tested on each substrate. Newborns non-randomly chose the arm with the mother's scent 87% of the time when tested on paper ($P < 0.001$) and 73% of the time when tested on sand ($P = 0.011$). When tested on leaf litter and burnt leaf litter, newborns chose the arm with the mother's scent 67% and 53% of the time ($P = 0.068$ and $P = 0.715$, respectively). Newborns also took longer to complete trials on paper compared to other substrates ($F_{3,112} = 10.26$, $P < 0.001$). Thus, substrate affected the ability of newborns to scent-trail their mother. In a natural setting, the heterogeneity of substrates may facilitate scent-trailing behavior as more conducive substrates may be present among substrates that impede scent-trailing behavior. However, as prescribed fire becomes a more popular forest management tool, care should be taken in where this tool is applied.

NEW SPECIES OF CHORUS FROG

O. E. Ospina et al. [2020, *Copeia* 108(4):778-795] note that a major driver generating amphibian diversity in the Appalachian Mountains is the complex paleogeography of the zone. Although the Appalachian Mountains have been widely studied, much of its amphibian phylogeography remains poorly known. The mountain chorus frog (*Pseudacris brachyphona*) is one example of an understudied organism due to its elusiveness, patchy distribution, and short breeding seasons. Phylogenetic studies have suggested the existence of divergent lineages within *P. brachyphona*; however, insufficient sampling and the lack of diagnostic morphological traits have prevented further assessment of their taxonomic status. Using a genome-wide nuclear data set obtained via anchored hybrid enrichment, acoustic data, and ecological modeling, the authors tested for the existence of cryptic species within *P. brachyphona*. Their species tree estimation supports previous mitochondrial-based phylogenetic hypotheses that separate *P. brachyphona* into the Northern and Southern clades. Population genetic clustering also shows a sharp genetic break, which is concordant with these clades. Admixture was observed between the Northern clade and another chorus frog species (*P. feriarum*). Analysis of advertisement calls shows a divergent, faster pulse rate, and higher dominant frequency call for the Southern clade in comparison to the Northern clade and other trilling chorus frogs. Furthermore, species distribution models showed that habitat suitability for the Southern clade included pine-dominated and drier areas compared to the Northern clade. In light of the genetic, acoustic, and ecological divergence between the clades, the authors propose to elevate the taxonomic status of the Southern clade and name this new species the Collinses' mountain chorus frog (*P. collinsorum*, new species). The name honors the husband-wife team of Joseph T. and Suzanne L. Collins. The new species ranges across northern Alabama, and extends into Georgia, eastern Mississippi, and southern Tennessee. *Pseudacris collinsorum*, new species, is geographically separated from its sister species, *P. brachyphona*, by the Tennessee River and surrounding Blue Ridge Escarpment. This study highlights the need for genus-wide, population-level genetic assessments and integrative data sets to uncover diversity within anurans.

DISPERSAL OF HATCHLINGS FROM NATURAL NESTS

G. A. Geller et al. [2020, *Chelonian Conservation and Biology* 19(2):236-245] note that despite its importance to individual fitness and population dynamics, the dispersal behaviors of most neonate freshwater turtles after nest emergence are poorly known. The authors studied the initial dispersal tendencies of neonate Ouachita map turtles (*Graptemys ouachitensis*) exiting natural nests during 2015–2017 along the Wisconsin River, Wisconsin. Overall, dispersal was nonrandom; hatchlings largely oriented toward the nearest substantial vegetative cover, a woodland north of the nesting area. However, variation sometimes occurred in routes taken among hatchlings within a clutch. Directional changes within an individual's dispersal track, including route reversals, were also observed. As this work appears to be the first to use standalone trail cameras as a primary data-gathering tool for a hatchling dispersal study, it highlights the potential benefits and limitations of this technique for similar research.

NESTING ECOLOGY OF THE KOMODO DRAGON

D. Purwandana et al. [2020, Copeia 108(4):855-862] studied annual trends and characteristics of nesting activities and hatchling production by female Komodo dragons (*Varanus komodoensis*) in Komodo National Park, Indonesia, between 2002 and 2006. During this period, they recorded 12, 16, 15, 13, and 6 females nesting annually at 42 potential nesting sites. An average female nesting periodicity was estimated at 1.2 ± 0.4 years. This result arose because most females bred annually and some biennially. Some females reused nest sites in successive years while others did not. Nesting females had significantly lower body mass compared to when they were recaptured again in a non-nesting state. All-female nesting activities were conducted within their resident valleys and suggested a strong tendency for spatial fidelity. Komodo dragons were generally considered solitary nesters as only on one occasion were two nesting females observed to use the same nesting site. On average, 21.0 ± 3.6 Komodo dragon hatchlings emerged from each nest. The authors estimate that within the study area, nesting female Komodo dragons produced between 129.0 ± 21.8 and 344.0 ± 58.16 hatchlings per annum. They discuss the ecological and evolutionary significance of these attributes. However, the main conservation management implications drawn from this study are that there are a low annual number of nesting females and associated hatchling production in Komodo National Park. Hence, a continuation of more extensive nesting surveys could provide a cost-effective and accurate way to gather important long-term demographic information for this species.

AMPHIBIAN PARENTAL CARE

L. M. Schulte et al. [2020, Herpetological Monographs 34:71-97] notes that despite rising interest among scientists for over two centuries, parental care has not been as thoroughly studied in amphibians as it has in other taxa. The first reports of amphibian parental care date from the early 18th century, when Maria Sibylla Merian went on a field expedition in Suriname and reported frog metamorphs emerging from their mother's dorsal skin. Reports of this and other parental behaviors in amphibians remained descriptive for decades, often as side notes during expeditions with another purpose. However, since the 1980s, experimental approaches have proliferated, providing detailed knowledge about the adaptive value of observed behaviors. Today, more than 30 types of parental care in amphibians are recognized, but most studies focus on just a few families and have favored anurans over urodeles and caecilians. The authors provide a synthesis of the last three centuries of parental care research in the three orders of amphibians. They draw attention to the progress from the very first descriptions to the most recent experimental studies, and highlight the importance of natural history observations as a source of new hypotheses and necessary context to interpret experimental findings. They encourage amphibian parental care researchers to diversify their study systems to allow for a more comprehensive perspective of the behaviors that amphibians exhibit. Finally, they uncover knowledge gaps and suggest new avenues of research using a variety of disciplines and approaches that will allow us to better understand the function and evolution of parental care behaviors in this diverse group of animals.

Minutes of the CHS Board Meeting, January 15, 2021

A virtual meeting of the CHS board of directors via Zoom conference video/call was called to order at 7:35 P.M. on January 15, 2021. Board member John Gutierrez was absent. Minutes of the December 3, 2020, board meeting were read and accepted.

Officers' reports

Treasurer: Rich Crowley went over the financial reports. Rich will be looking to analyze our financial situation. We need to look into fund-raising and attracting donations.

Vice-president: The speaker who had been scheduled for January may fall through. Rachel Bladow is looking into finding a backup.

Media secretary: Stephanie Dochterman shared some thoughts on possible topics to enhance the website and our Facebook, Twitter and Instagram accounts.

Membership secretary: Mike Dloogatch reported that membership has dipped slightly below 400.

Committee reports

Shows: Rich Crowley has spoken with Scott Smith, who is

willing and might be able to give us a table at the All Animal Expo and cover us under his insurance. Rich will try to follow through on this. Rich also said that Rob Carmichael is going to try to have a virtual Reptile Rampage this year (March 14). There was a discussion of the CHS putting together programs for people to view in exchange for a donation.

ReptileFest: Could possibly be held in the fall. Who will run it if Frank Sladek is not available?

Grants: We have received 20 applications for grants this year. Mike Dloogatch moved to allocate funds not to exceed \$5,000 for grants in 2021. The motion passed unanimously.

Old business

CHS history: Rich Crowley would really like to dig deeper into this, especially getting more of the story on what impact we have had on the community.

The meeting adjourned at 9:10 P.M.

Respectfully submitted by recording secretary Gail Oomens

Advertisements

For sale: **highest quality frozen rodents.** I have been raising rodents for over 30 years and can supply you with the highest quality mice available in the U.S. These are always exceptionally clean and healthy with no urine odor or mixed in bedding. I feed these to my own reptile collection exclusively and so make sure they are the best available. All rodents are produced from my personal breeding colony and are fed exceptional high protein, low fat rodent diets; no dog food is ever used. Additionally, all mice are flash frozen and are separate in the bag, not frozen together. I also have ultra low shipping prices to most areas of the U.S. and can beat others shipping prices considerably. I specialize in the smaller mice sizes and currently have the following four sizes available: Small pink mice (1 day old—1 gm) , \$25 /100; Large pink mice (4 to 5 days old—2 to 3 gm), \$27.50 /100; Small fuzzy mice (7 to 8 days old—5 to 6 gm), \$30/100; Large fuzzy mice / hoppers (10 to 12 days old—8 to 10 gm), \$35/100 Contact Kelly Haller at 785-224-7291 or by e-mail at kelhal56@hotmail.com

Line ads in this publication are run free for CHS members — \$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to mdloogatch@chicagoherp.org.

NEW CHS MEMBERS THIS MONTH

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Dr. Angela Duke
Kate A. Keets
Ralph Kietzman
Robert W. McKeever
Patrick Murphy
Ari Rosenblum

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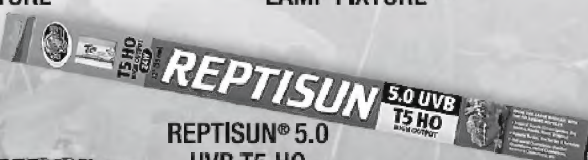
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UPCOMING MEETINGS

Until in-person meetings again become possible the Chicago Herpetological Society will be holding monthly general meetings online via Zoom Webinar. A notification will be sent by email to all members who have supplied us with an email address. As has been our custom for over 50 years, the meetings will be held on the last Wednesday evening of each month. The February Webinar is scheduled for Wednesday, February 24, at 7:30 P.M. Chicago time. Our speaker will be **Jennifer Lamb**, assistant professor of biology at St. Cloud State University. She will speak about “Illuminating the Unknown: Amphibian Biofluorescence.” Jen began her current position in 2018 and has been enjoying getting to know the herps and habitats in central Minnesota. Her research explores the natural history, biology, ecology, and conservation of amphibians and reptiles. Her lab has recently begun to explore the world of amphibian biofluorescence, a new field with interesting avenues for future work and for collaboration

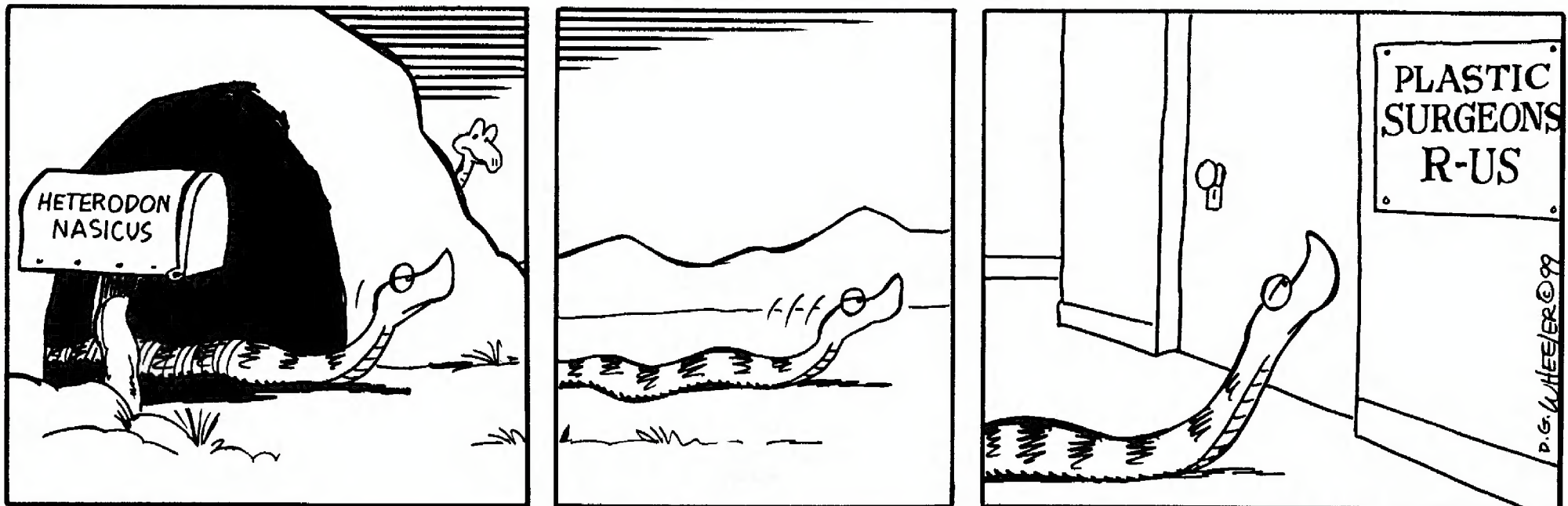
Please check the CHS website or Facebook page each month for information on the program. Information about attending a Zoom Webinar can be found here:

<[https://support.zoom.us/hc/en-us/articles/115004954946-Joining-and-participating-in-a-webinar-attendee->](https://support.zoom.us/hc/en-us/articles/115004954946-Joining-and-participating-in-a-webinar-attendee-)

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? The next board meeting will be held online. If you wish to take part, please email mdloogatch@chicagoherp.org.

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